BUILDING
SAFETY AND
SECURITY
RESEARCH
AREAS

U.S. DEPARTMENT OF COMMERCE / National Bureau of Standards

National Engineering Laboratory / Center for Building Technology / Environmental Research Design Division

MOBILE HOME SAFETY

The Mobile Home Construction and Safety Standards of the Department of Housing and Urban Development are a direct response to a Congressional mandate to improve the safety and construction quality of mobile homes. To help achieve these ends, the Building Safety and Security Group is currently evaluating the egress requirements of the Mobile Home Standards.

Interdisciplinary research is being conducted to examine the physical and behavioral characteristics of mobile home occupants, egress device requirements, tenability criteria, and economic impact of egress requirements.

This work is being supported by laboratory investigations of the Human Factors Group of the Center for Consumer Product Technology. Research findings will be presented in the form of a summary report that documents the technical basis of the recommendations and, where appropriate, justifies changes to the scope and technical requirements of the standards.

BUILDING ACCESSIBILITY

As a national center for architectural research, the Environmental Design Research Division is assuming a leadership role in promoting a built environment that is accessible for the handicapped. The Building Safety and Security Group is providing technical support to the Architectural and Transportation Compliance Board of the Department of Health, Education and Welfare in the development of accessibility guidelines for Federally sponsored facilities and design standards suitable for consideration by regulatory agencies and model code groups. The three-phase project will first analyze and summarize existing accessibility documents, then determine areas of agreement and areas where additional research is needed, and finally sponsor or carry out research activities required to develop accessibility guidelines which are rational and feasible.

A major feature of the project is a plan to encourage all groups with an interest in the guidelines (designers, builders, owners, regulators, users, etc.) to participate in the project.

Individual research activities dealing with pressing building accessibility problems, such as doorway and entrance design, are being carried out concurrently with overall standards analysis.

EMERGENCY EGRESS

An important aspect of the design and construction of buildings is the provision of adequate means for emergency egress. Many of the existing requirements for the design of egress facilities were developed thirty to fifty years ago and are based on assumptions which are being successfully challenged today. The Emergency Egress Activity project in the Building Safety and Security Group (BSSG) seeks to improve standards governing emergency egress facility design. This activity emphasizes computer modeling and simulation techniques to achieve a state-of-the-art understanding of the behaviors and needs of building occupants during fires, earthquakes, and other emergencies.

The central technical focus of the Emergency Egress Activity is "BFIRES," a computer program originally designed to simulate the emergency egress movements of building occupants during fires. BFIRES is based on an "information processing" model of human behavior. According to this model, persons in an emergency situation are thought to actively seek out and interpret information from their environment, and to use that information to identify and evaluate behavioral alternatives as they proceed through the emergency. They interpret such information on the basis of their personal experience, objectives, and needs, and in accordance with various emotional controls. BFIRES simulates fires by enabling the user to establish initial conditions which describe the building, the fire, and the occupants, and then to run any number of simulated fires. Because human behavior is simulated as a stochastic process, successive replications based on a single set of initial conditions will produce a distribution of different (rather than identical) event outcomes. The user can compare outcomes generated under each of several sets of initial conditions, making use of standard statistical procedures. BFIRES, written in FORTRAN V, is currently available in two versions on the NBS UNIVAC 1108 computer.
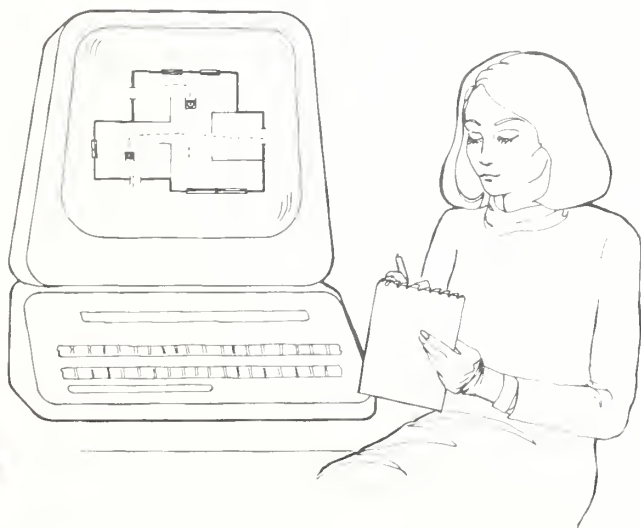
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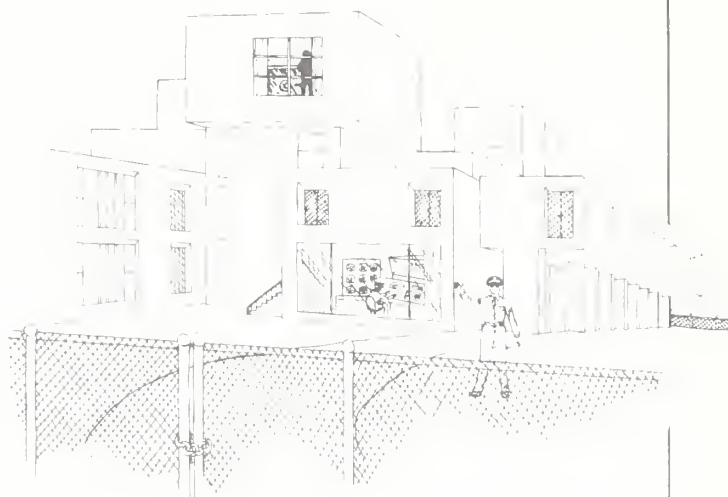
The Building Safety and Security Group (BSSG) investigates how to improve security in buildings and other facilities. Changes in crime patterns in museums, residences, and other U.S. sites, as well as the need to safely store and handle hazardous nuclear fuels, has called attention to technical needs in security. Requirements are examined for comprehensive and systematic security analysis methods, techniques developed for analyzing security risk, standards developed for critical security hardware, and demonstrations conducted in the laboratory and the field to verify findings.

A major thrust in the security activity of BSSG is the application of advanced mathematical and systems techniques—developed for aerospace, defense, and nuclear power—to the topic of security analysis. Event tree analysis, fault tree analysis, and other systems concepts which are transferable enhance the discipline of security engineering. In addition, mathematical modeling and computer mapping techniques have promising futures in the security discipline.

BSSG is presently conducting research for the Department of Housing and Urban Development and the Department of the Navy on security issues. Field demonstrations are underway to verify effectiveness of various classes of security hardware in reducing the incidence of burglary in low-cost housing.

SYMBOLS RESEARCH

The Building Safety and Security Group (BSSG) is engaged in a program to evaluate the effectiveness of graphic symbols and pictorials for use in workplaces. The current trend is toward the use of symbols. Typically, these are without evaluation of, or agreement upon, an effective set in all fields, including that of safety. Yet the need to test, evaluate, and standardize safety symbols is urgent, because the penalty for poor or erroneous communication could be serious injury or death. For example, a preliminary analysis of fire-safety symbols by the BSSG indicated that several symbols, such as exit, were not understood by the vast majority of those questioned. Still other symbols, such as no exit, were given a totally opposite meaning. These examples illustrate the kind of problems that can arise when symbols are not tested and evaluated.

The BSSG is currently reviewing various testing and evaluation methods in the course of preparing a state-of-the-art report on symbol use and testing. It is also developing a research plan for which different test methods will be assessed. In addition, it will conduct a project for the National Institute of Occupational Safety and Health (NIOSH) in which current practice in work environments will be surveyed, existing symbols catalogued, and selected symbols evaluated. This project will provide recommendations to NIOSH on the effective use of safety symbols in the workplace. A similar effort is planned for the Bureau of Mines. In this way, safety symbols will be evaluated for all workplaces (since OSHA and MSHA have separate responsibilities for worker safety). In the course of the work for NIOSH and the Bureau of Mines, the BSSG will continue the assessment of various evaluation techniques and develop methods for determining the characteristics of effective symbols. It will also be active in voluntary standards groups such as the American National Standards Institute, the National Fire Protection Association, and the International Safety Organization.